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DR. KOCH'S DISCOVERY.

BY PAUL GIBIER, M. D., DIRECTOR OF THE NEW YORK PASTEUR
INSTITUTE.

WITHIN a few days public attention has been much excited over the announcement of a discovery of the greatest importance—that of a cure for tuberculosis. I shall attempt to prove that this discovery presents not only a medical interest, but also a social interest, the effects of which will be incalculable, if the fact of Professor Koch's discovery becomes established.

It would be inopportune in a paper of this kind to analyze the studies made of the tubercle from an anatomic point of view; however, a word on its history will not be useless. Laennec* was the first to give an exact notion of the tubercle; then came Reinhardt† and Virchow,‡ who have given a good description of tuberculous lesions. The tubercle is a mass of cells caused by the presence in the tissues of certain microscopic beings, living strangers developing themselves at the expense of the elements of our organs. Their form is that of a little stick composed of round grains very near each other, and a microscope enlarging at least 500 times is necessary to perceive one of these bacilli.

The contagiousness of tuberculosis appears to have been perceived by physicians anterior to those I have just mentioned. Thus, Malpighi, in one of his letters, declares that he would not consent to make the autopsy on a man who had died of consumption even if the kingdom of France were offered to him. Laennec, to whom I have referred, seems to have had an idea of the inoculableness of that disease. In sawing tuberculous vertebræ, he inflicted a slight wound on his finger: the result of this wound

* "Traité de l'Auscultation Médiate," 2d édit., 1826.

† "Uebereinstimmung der Tuberkelablagerung," etc. (Annalen d. Charité), Berlin, 1850.

‡ "Die Tuberculose" (Verhandl. d. phys. med., Gessellsch. 1855).

was the development of a small tumor containing caseous matter, which he cauterized with protochloride of antimony. Laennec died of phthisis. But the man who really proved the inoculableness of the tuberculous substance is a French army physician, Dr. Villemain, who by his numerous experiments proved at the same time the contagious nature of the tubercle and its identity with caseous lesions of a scrofulous nature.

Pasteur proved the part played in contagious diseases by microbes, which he was the first to cultivate outside of the living organism. When he had cultivated not only the microbe of anthrax, but also those of chicken cholera and of the furuncle, etc., learned men, who had before their minds Villemain's discoveries, judged that, tuberculosis being a contagious disease, the element of the contagion must be a microbe analogous to those in the diseases I have already mentioned, and a considerable number of investigators set to work to discover it. A French scholar, Dr. Toussaint, obtained growths of an organism presenting the appearance of small grains in chaplets. He cultivated these organisms in broth. I have examined the organs of animals (rabbits) inoculated by Toussaint with the seventeenth culture of this microbe, and the microscopic examination of the lesions showed, with the aid of appropriate reactions, the characteristic bacillus of tuberculosis.

At this time Robert Koch made known his discoveries on the same question. He indicated a particular process to color the productions of the tuberculous patients, by the aid of which the existence of the tuberculous bacillus in the special pathological lesions is placed in complete evidence. And, what is more important, he announced simultaneously that he had cultivated that bacillus in an inert nutritious medium, and that this culture, repeated several times on a similar substance, could by inoculation give tuberculosis to animals. We may say that, in spite of previous attempts, the discovery of the bacteria of tuberculosis was made by Robert Koch.

Let us now examine the side of the question which is most particularly the object of this article. At the moment when these lines are written a few favorable results following the application of the method of inoculation for the cure of tuberculosis have been brought to us by cable; but we are still ignorant of the composition of the liquid used for the injections. The field,

therefore, remains open, and we shall give a free course to our own suppositions.

It was at the recent Medical Congress in Berlin that Robert Koch publicly announced for the first time that he had found the means of arresting the development of tuberculosis in animals. His experiments had been made on guinea-pigs. These animals are even more sensitive than man to the action of the tuberculous bacillus. All the experimenters that I met at the congress in Berlin were of the same opinion. We agreed, first, that from the moment Koch communicated a fact of so great importance, that fact must exist; second, that, the guinea-pig being an animal very sensitive to tuberculosis, if a method existed to prevent the evolution of the tuberculous bacillus in the tissues of that animal, the success of that method could, *a fortiori*, be predicted in the case of man.

It is now about ten years since Koch began his experimental researches on tuberculosis. When I studied in his laboratory in 1885, he had made known, three years before, his method for the cultivation of the bacillus. His ten years of laborious and persistent research are highly rewarded. *Finis coronat opus*.

According to the communications which have reached us, what can we presume in regard to this new method of treating consumption? The injection is composed of lymph; if we are well informed, this lymph is a transparent and brownish liquid. I suppose the word lymph is meant to be the equivalent of *serum sanguinis*. It was, in fact, in the serum that Koch made his first cultivation of the tuberculous bacillus. A few drops of this liquid injected in the cellular sub-cutaneous tissue of a healthy man produce but little effect. On the contrary, in a person attacked by tuberculosis the reaction is more or less strong; the visible tuberculous lesions, notably those of the skin, modify themselves before our eyes, the whole accompanied by a feverish period of short duration, but quite intense. The inoculations must be continued during several weeks. They are made in the region of the back, above the loins, in the place where the injections to protect one from hydrophobia are now made.

Persons who have applied to me for information on this subject of so great present interest have all asked about the same questions—What can that liquid be? Does it act like the liquid used to inoculate against hydrophobia? Is it a substance ana-

logous to vaccine, used as a preventive for small-pox? Or are there attenuated growths like those employed in Pasteur's method against anthrax? Or is it a powerful antiseptic acting through a special tendency upon the tuberculous bacillus?

I think we can even now eliminate all kinds of comparison between Koch's liquid and the virus, composed of nervous rabic matter, which is injected into persons bitten by dogs suspected of or attacked by hydrophobia. I should say as much of what concerns the Jennerian vaccination against small-pox, from this fact, that, if we are well informed, the liquid injected in Berlin is clear and transparent; unlike the others referred to, it contains no solid particles in suspension. We should for the same reason eliminate the supposition that it is an attenuated culture. Finally, we know that tuberculosis is a disease specially subject to relapses: a first attack, far from protecting against subsequent attacks, constitutes rather a reserved seed which will become developed at a suitable time, when the composition of the soil—that is, the constitution of the affected individual—lends itself to it.

It has been proposed to treat tuberculosis by injections of bacilli antagonistic to those which produce the disease. It is, perhaps, to an antagonism of this kind that we owe the protection of the Jennerian vaccination against small-pox, although certain pathologists are disposed to see in the microbe of vaccination an organism identical with that of small-pox, but attenuated by its passage through certain animals, like those of the equine and bovine species. But this is not the process employed by Dr. Koch.

By elimination we remain in presence of two hypotheses. One is that Robert Koch has found in his researches a chemical compound, an agent of a special antiseptic power, which fastens on the bacillus of tuberculosis; a very small quantity of this antiseptic (chloride or cyanide of gold, silver, or platinum, for instance) would be sufficient to destroy the contagious germ, and then this antiseptic would act after the manner of nitrate of silver on the *aspergillus niger* experimented upon by Raulin,* which suffices, with one-sixteen-hundred-thousandth ($\frac{1}{160000}$) of this salt added to a nutritious liquid where this mucor is cultivated, to arrest its development instantaneously. If the *aspergillus niger* in question was a human

*"Ferments et Maladies," Duclaux, Paris. 1882.

parasite determining a disease analogous to consumption, and even capable of invading the entire human body, the necessary weight of nitrate of silver to radically cure a man of medium height affected with this supposed malady would not be over one grain. Is it not permissible to admit that in nature, and even among the chemical agents which we have in our laboratories, there may be found one or several substances capable of acting as powerfully on the different bacilli that are the agents of the zymotic diseases with which our race is afflicted? It is, therefore, a sort of equation which might be thus established: *Nitrate of silver is to aspergillus niger as x is to tuberculous bacillus*, or any other contagious disease:
$$\frac{A_g A_z O^s}{A N} \quad \frac{x}{T}$$

The foregoing hypothesis appears very reasonable, and yet another possibility presents itself to the mind. It is a fact well known in laboratories of bacteriology that, when a microbe has developed itself in a medium of liquid cultivation, at the end of a certain time a cessation in the development of the microbe is observed. The liquid, however, is not exhausted; another microbe of a different species may be developed if it is added to the first. But, instead of proceeding thus, if the liquid is filtered so as to retain the first germs which have been developed there, and if new microbes of the same species in full vitality are added, no new change can be observed in the centre of culture. This is because the microbes have the function, among others, of secreting chemical substances, more or less active, constituting veritable poisons for the bacillus that produced them. The substances which of late years have been studied under the name of ptomaines can be extracted from the liquid, sometimes in the shape of crystals suggesting those of the alkaloids drawn from various vegetables such as strychnine, digitaline, etc.

The liquid employed by Dr. Koch is perhaps only a concentrated solution of a special ptomaine, extracted from the culture of the tuberculous bacillus. The action of ptomaines injected under the skin of animals is generally slower than that which follows the injection of alkaloids. Dr. Koch's liquid injected in the same manner in man produces a variety of symptoms appearing only after four or five hours. This is perhaps an indication of what it is.

In this hypothesis the ptomaine injected consecutively during

several weeks into the system would modify the medium of growth of the tuberculous bacillus so as to check its development. The cells of the organism, finding no more obstacles, would regain strength. That would explain why the ptomaine injected efficaciously under the skin remains without effect when introduced through the digestive organs, as seems established in regard to the substance used by Dr. Koch. This difference of action does not exist in a similar degree in the case of metallic substances.

The future will soon teach us the truth about the nature and real value of the antidote used by the illustrious German professor, and if the hope we have cherished be not a vain one, we shall perceive before long how important, from a social and economical stand-point, the cure of tuberculosis is. We know that in the civilized world more than a million persons die annually in middle age, their lives being cut short by this terrible bacillus. From the results already obtained we may hope that all attacks of tuberculosis, pulmonary or other, can be checked, at least *in the beginning*.

The hospitals are full of patients attacked by different forms of tuberculosis; they lie there awaiting the coming—more or less slow—of death to deliver them. Thanks to Dr. Koch's discovery, these patients will soon be restored to activity.

Robert Koch deserves the praise of humanity.

PAUL GIBIER, M.D.